clutch becomes equal to a set value of the engine absorption torque, said set value of the engine absorption torque being a value obtained by multiplying a reference value of the engine absorption torque corresponding to the engine speed by a predetermined safety factor, and

wherein said second control means controls said actuator based on the control target value while detecting the slippage ratio of said starting clutch and feedback correcting said control target value such that said slippage ratio becomes equal to or less than a predetermined value.

REMARKS

The Office Action dated February 27, 2003 has been received and carefully noted. The amendments made herein and the following remarks are submitted as a full and complete response thereto.

Applicant appreciates the indication of allowable subject matter in claims 2, 3 and 5. The Specification has been amended to overcome minor informalities therein. In addition, claim 2 has been amended to overcome a minor spelling error. No new matter has been added by the amendment made herein. Therefore, claims 1-5 are pending in the present application and are respectfully submitted for consideration.

The specification was objected to because the specification contained some minor informalities therein. As noted above, the specification has been amended to correct the informalities noted in the Office Action. Accordingly, Applicants submit that the amendments made to the specification overcome the objection.

Claim 2 was objected to as containing a minor spelling error. Claim 2 has been amended to correct the spelling error, and therefore claim 2 is now in compliance with U.S. patent practice.

Claims 1 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu et al. (U.S. Patent No. 6,071,211, hereinafter "Liu") in view of Streib (U.S. Patent No. 6,165,104). In making this rejection, the Examiner took the position that Liu disclosed each and every element recited in the claimed invention with the exception of showing a delay means for delaying the start of control based on the third control means until a predetermined time after the accelerator pedal is depressed. The Office Action cited Streib for curing the deficiencies which exist in Liu. Applicants respectfully traverse this rejection and submit that each of claims 1 and 4 recites subject matter that is neither disclosed nor suggested in the cited prior art.

Claim 1 recites a vehicle starting clutch control device for arbitrarily controlling a transmission torque capacity of a starting clutch through an actuator. The vehicle starting clutch control device includes a first control means, a second control means, a third control means and a delay means. The first control means control the actuator so that the starting clutch is put in a state that the starting clutch completely transmits the output torque of an engine at the time of power-on running with an accelerator pedal being depressed. The second control means controls the actuator so that the transmission torque capacity of the starting clutch becomes a value required to transmit a torque equal to an engine absorption torque corresponding to the engine speed at the time of power-off running without the accelerator pedal being depressed. Furthermore, the third control means controls the actuator so that the transmission torque capacity of the starting clutch is gradually increased to shift the starting clutch to the completely

transmitted state when the accelerator pedal is depressed during power-off running. The delay means delay the start of control based on the third control means until a predetermined time after the accelerator pedal is depressed.

Accordingly, the present invention provides a vehicle starting clutch control device in which the transmission torque capacity of a starting clutch can arbitrarily be controlled by an actuator. Therefore, the present invention results in the advantage of having a vehicle starting clutch control device which can prevent the generation of surging vibration when the accelerator pedal is abruptly depressed during power-off running.

It is respectfully submitted that the prior art fails to disclose or suggest at least the element of the third control means for controlling the actuator so that the transmission torque capacity of the starting clutch is gradually increased to shift the starting clutch to the completely transmitted state when the accelerator pedal is depressed during power-off running, and therefore fails to provide the advantages which are provided by the present invention, as claimed.

Liu discloses a vehicular automated mechanical transmission system 10 advantageously utilizing the idle drive torque master clutch control. The system 10 includes a fuel-controlled engine 12, a wet master friction clutch 14 and a multiple-feed mechanical transmission 15. The engine controller 28 is provided for controlling fuelling of the engine and for providing output information to an electronic data link. Furthermore, system 10 also includes a clutch actuator 30 for controlling operation of clutch 14 and a transmission actuator 32 for controlling operation of transmission 16. A sensor 33 is provided for sensing throttle 33A position and providing a signal THL indicative thereof.

To engage the clutch to the idle drive torque level, the engine controller of Liu first maintains the engine speed at a desired idle RPM by sending the appropriate engine torque request to the engine. When the engine control loop achieves its balance, the amount of torque request may be equal to that of engine friction torque (as desired idle RPM), plus the clutch torque (0 if not engaged). The system of Liu will then try to engage the clutch gradually to the level of desired idle drive torque (26 pound-feet). Furthermore, the system uses the value of torque request as the feedback reference. As the clutch is being engaged gradually, the load to the engine increases and, hence, slows down the engine feed. In response to the speed change, the engine controller will increase the torque request to the engine to maintain the engine speed at the desired idle RPM.

Streib discloses a system for controlling a clutch and/or a motor of a vehicle. Streib shows that the drive signal of the clutch is formed in dependence upon a signal which represents a change of the motor torque of a specific extent. Streib also shows a system for controlling the motor of the vehicle with an adjusting element for influencing the motor torque which can adjusted at least independent upon the detected command torque. When the specific extent of a change of motor torque is present, the execution of the command to adjust the motor torque is delayed. The clutch of Streib is arranged between the vehicle motor and the wheels of the vehicle and the delay is actuated independent upon a status signal representing the instantaneous operating state of the clutch.

Applicants respectfully submit that each and every element recited within claim 1 of the present application is neither disclosed nor suggested by Liu and/or Streib, taken alone or in combination. In particular, Applicants respectfully submit that the vehicle

starting clutch control device for arbitrarily controlling a transmission torque capacity of a starting clutch through an actuator as recited in the present application is clearly distinct from that which is illustrated in Liu and/or Streib. Specifically, it is submitted that both Liu and Streib fail to disclose or suggest at least the limitation of the third control means for controlling the actuator so that the transmission torque capacity of the starting clutch is gradually increased to shift the starting clutch to the completely transmitted state when the accelerator pedal is depressed during power-off running.

As mentioned above, Liu merely discloses a control for a vehicle drive line system in which at sensed idle conditions, the engine is commanded to generate an output torque equal to a selected idle drive torque at idle speed, and the engine is commanded to rotate at idle speed whereby the clutch is engaged with a torque capacity equal to the idle drive torque. However, it is submitted that Liu fails to disclose or suggest a third control means for controlling the actuator so that the transmission torque capacity of the starting clutch is gradually increased to shift the starting clutch to the completely transmitted state when the accelerator pedal is depressed during power-off running.

Also, Streib merely discloses a clutch that is mounted between the vehicle motor and the wheels of the vehicle and the delay is actuated independent upon the status signal representing the instantaneous operating state of the clutch. Applicants submit that Streib fails to cure the deficiencies which exist in Liu because Applicants submit that Streib also fails to disclose or suggest a third control means for controlling the actuator so that the transmission torque capacity of the starting clutch is gradually increased to shift the starting clutch to the completely transmitted state when the accelerator pedal is depressed during power-off running.

Further, Applicants submit that neither Liu nor Streib, nor the combination thereof discloses or suggest a vehicle standing clutch control device that includes means for controlling an accelerator such that a starting clutch transmits a tongue with an accelerator pedal being depressed, as claimed in claim 1.

In view of the above, Applicants respectfully submit that neither Liu nor Streib, taken alone or in combination, disclose or suggest each and every element recited within claim 1 of the present application.

As for claim 4, Applicants submit that claim 4 recites subject matter which is neither disclosed nor suggested by the prior art. In particular, claim 4 depends on claim 1. Therefore, claim 4 incorporates each and every limitation recited within claim 1 therein. Accordingly, Applicants submit that claim 4 also recites subject matter which is neither disclosed nor suggested by Liu and/or Streib for at least the reasons set forth above with respect to claim 1.

In view of the above, Applicants respectfully submit that claims 1 and 4 each recite subject matter which is neither disclosed nor suggested in the cited prior art. Applicants also submit that the subject matter is more than sufficient to render the claims non-obvious to a person of ordinary skill in the art, and therefore respectfully requests that claims 1 and 4 be found allowable along with allowable claims 2, 3 and 5, and that this application be passed to issue.

If for any reason, the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact by telephone the Applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper has not been timely filed, Applicants respectfully petition for an appropriate extension of time. The Commissioner is authorized to charge payment for any additional fees which may be required with respect to this paper to Counsel's Deposit Account 01-2300, referring to Attorney Docket number 107355-00045.

Respectfully submitted,

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5/23/03
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Enclosures: Marked-Up Copy of Amended Specification
Marked-Up Copy of Amended Claim

MARKED-UP COPY OF AMENDED SPECIFICATION

Page 4, paragraph 1, beginning at line 1:

According to the aspect of the invention, the time when the third control means starts to control to gradually increase the transmission [toque] torque capacity of the starting clutch is delayed from the timing when the accelerator pedal is depressed. Therefore, even if there is a delay in building up of the output torque of the engine, the transmission torque capacity of the starting clutch has not increased as high as the conventional art when the output torque of the engine actually builds up, and there is produced a slippage in the starting clutch. Thereafter, as the transmission torque capacity of the starting clutch increases, of the output torque of the engine, the ratio of output torque which is to be transmitted to the drive wheels via the starting clutch is increased. Consequently, even if the accelerator pedal is abruptly depressed during power-off running, the drive torque of the drive wheels is allowed to build up moderately, whereby the generation of surging vibrations is prevented. The predetermined time may be determined depending upon time that has elapsed since the accelerator pedal is depressed, or time may be determined as the predetermined time when a detected engine output torque exceeds the transmission torque capacity of the starting clutch.

Page 7, paragraph 1, beginning at line 15:

Note that in an embodiment of the invention which will be described later, step S2 shown in Fig. 4 corresponds to the first control means, steps S4 to S6, S11 and S12 in Fig. 4 to the second control means, and steps S18, S19 in Fig. [2] 4 to the third control means, and steps S14 to S17 in Fig. 4 to the delay means.

Page 8, paragraph 7, beginning at line 25:

A mechanical friction clutch for use on a vehicle with a clutch pedal is used for the starting clutch 2, which is normally engaged by virtue of the biasing force of a diaphragm spring 2a, whereas it is disengaged by a release fork 2b via a release bearing 2c, when the diaphragm spring 2a is pressed in. Then, a piston rod 9a of a hydraulic cylinder 9 serving as an actuator is brought into abutment with the release fork 2b so as to operate the release fork 2b by the hydraulic cylinder 9, to thereby arbitrarily control the transmission torque capacity of the starting clutch 2. As shown in Fig. [2A] 2, a hydraulic circuit 10 of the hydraulic cylinder 9 includes an electromagnetic control valve 101 which is controlled by a clutch controller 11. The clutch controller 11 is adapted to control the supply and discharge of hydraulic oil to and from the hydraulic cylinder 9. Oil discharged from an electric pump 103 is supplied to an oil supply path 102 communicating a control valve 101 via a check valve 104. The electric pump 103 has, as a driving source, a motor 103a which is controlled by the clutch controller 11. Connected to the oil supply path 102 are a relief valve 105, an accumulator 106 and an oil pressure sensor 107, whereby signals from the oil pressure sensor 107 are inputted into the clutch controller 11. And, in case the oil pressure in the oil supply 102 detected by the oil pressure sensor 107 decreases below a predetermined line pressure, the electric pump 103 is driven until the oil pressure in the oil supply path 102 reaches the predetermined line pressure.

Page 11, paragraph 2, beginning at line 21:

When the vehicle is started, the transmission torque capacity of the [stating] starting clutch 2 is controlled so as to gradually increase whereas the [stating] starting clutch 2 is controlled to be disengaged when the brake pedal 13 is depressed. In addition, while the vehicle is running, as shown in Fig. 4, it is determined whether or not the vehicle speed V is a predetermined vehicle speed YV or more (S1), and in case $V \geqq YV$, transmitted to the controller 11 is a state in which the starting clutch 2 completely transmits the engine output torque or a stroke position of the piston rod 9 where the transmission torque capacity (clutch torque) of the starting clutch 2 becomes equal to or greater than the engine output torque as a target position (S2).

Page 16, paragraph 1, beginning at line 14:

When the predetermined time t has elapsed, in order to carry out a ramp control in which the piston rod 9a is gradually displaced from the predetermined clutch holding position to a position where the clutch torque reaches or exceeds the engine output torque, a ramp control position is calculated where the position of the piston rod [9s] 9a is gradually changed from the predetermined clutch holding position to the position where the clutch torque reaches or exceeds the engine output torque (S18), and this ramp control position is transmitted as a target position to the clutch controller 11 (S19). Then, the first flag F1 is reset at [0] and the second flag F2 is set at [1] (S20). Thus, it is determined as [YES] in step S13 after the ramp control has been completed, and in this case, the flow proceeds to step S2, where the position where the clutch torque reaches or exceeds the engine output torque is sent to the clutch controller 11 as a target position.

MARKED-UP COPY OF AMENDED CLAIM

2. (Once Amended) The vehicle starting clutch control device according to claim 1, wherein said second control means sets as a control target value a control amount of said actuator such that the transmission torque capacity of said starting clutch becomes equal to a set value of the engine absorption torque, said set [valve] value of the engine absorption torque being a value obtained by multiplying a reference value of the engine absorption torque corresponding to the engine speed by a predetermined safety factor, and

wherein said second control means controls said actuator based on the control target value while detecting the slippage ratio of said starting clutch and feedback correcting said control target value such that said slippage ratio becomes equal to or less than a predetermined value.